Support for the Amendments

Support for the present claim amendments can be found throughout the specification, claims and figures as originally filed. Without being limited to such exemplary passages and/or other disclosures, support for the amendments to claim 1 can be found in the specification on page 4, lines 1-9 and in the figures in FIGS. 2A-2B and 3E; support for new claim 9 can be found in the specification on page 4, line 9; support for new claims 10-11 can be found in the specification on page 4, lines 14-15; support for new claims 12-14 can be found in the specification on page 4, lines 18-19 and in the figures in FIG. 2A; support for new claim 15 can be found in the specification on page 4, lines 20-25 and page 6, lines 7-16, and in the figures in in FIGS. 2B and 3E; support for new claims 16-17 can be found in the specification on page 4, lines 12-13; and support for new claims 18-19 can be found in the specification on page 6, lines 4-6 and in claim 4 as originally filed. Thus, no new matter is introduced by the present Amendment.

Remarks

Applicant and his representatives wish to thank Examiner Goudreau for the courteous and helpful discussion with Applicant's undersigned representative on January 3, 2005. The last clause of Claim 4 has been amended as suggested by the Examiner to clarify the wording therein. The claims (notably claims 1 and 4) now include language that requires the adhesive metal layer to be on an inside or inner surface of the contact hole (e.g., so-called "sidewalls" of the contact hole), but that exposes an underlying metal wire layer, generally corresponding to the structure of the adhesive metal layer 12 as shown FIGS. 2A-2B and 3E, as discussed on January 3, 2005.

The present invention relates to a bonding pad and method of making the same. The bonding pad (as set forth in amended Claim 1 above) generally comprises:

a) a barrier metal layer;

b) a metal wire layer on the barrier metal layer;

c) a passivation metal layer on the metal wire layer, having a removed portion exposing the metal wire layer;

d) an insulating layer on the passivation metal layer and having a contact hole therein exposing the metal wire layer via the removed portion of the passivation metal layer; and

e) an adhesive metal layer on an inner surface of the contact hole, also exposing the metal wire layer.

The method (as set forth in amended Claim 4 above) forms the adhesive metal layer by dry-etching a metal layer to remove portions thereof on upper surfaces of a passivation layer and an underlying metal wire layer, thus leaving a portion of the metal layer on an inside surface (e.g., a sidewall) of a contact hole in the passivation layer and exposing the metal wire layer. The reference cited against the originally-filed claims (Dass et al., U.S. Pat. No. 6,162,652 [hereinafter "Dass et al."]) neither discloses nor suggests (i) a passivation metal layer having a removed portion exposing an underlying metal wire layer or (ii) an adhesive metal layer on an inside or inner surface of the contact hole that exposes an underlying metal wire layer (see amended Claims 1 and 4). Consequently, the present claims are patentable over the cited reference.

The Rejection of Claims under 35 U.S.C. § 102(b)

The rejection of Claims under 35 U.S.C. § 102(b) as being anticipated by Dass et al. is respectfully traversed.

Dass et al. discloses a method of testing an integrated circuit device, including depositing a solder bump on a surface of a bond pad on the integrated circuit device, heat treating the solder bump, and probing the solder bump (Abstract, ll. 1-5). The bond pad 110 of Dass et al., which is electrically connected to a transistor device at the base of integrated circuit device 100, is (for example) a metal layer, such as aluminum (Al), aluminum-copper (Al—Cu) alloy, or aluminum-

copper-silicon (Al--Cu--Si) alloy (col. 5, ll. 40-48 and FIG. 6). Thus, bond pad 110 appears to correspond to the metal wire layer recited in the present claims.

Overlying bond pad 110 is hard passivation layer 115, such as for example silicon nitride (Si_3N_4) deposited to a thickness of approximately 750 nanometers (nm), and above hard passivation layer 115 is a soft passivation layer 120, such as for example a photodefinable polyimide passivation layer deposited to a final thickness of approximately 3.3 μm (col. 5, ll. 52-60). An opening is formed through soft passivation layer 120 and hard passivation layer 115 to bond pad 110, to provide electrical contact to bond pad 110 (col. 5, ll. 63-66 and FIG. 7). This opening appears to correspond to the "contact hole" recited in the present claims.

Once an opening 125 is made to bond pad 110, a first base layer conductive material 130 is uniformly deposited over the surface of device 110. First base layer conductive material 130 is a layer of titanium (Ti) deposited to a thickness of approximately 500 Å (col. 6, ll. 35-40 and FIG. 8). One purpose of the first base layer conductive material 130 is to improve the contact resistance between a subsequently deposited solder bump and bond pad 110 (col. 6, ll. 40-43). Thus, first base layer conductive material 130 may correspond to the passivation metal layer recited in the present claims. Next, a second base layer conductive material 135 is uniformly deposited over integrated circuit device 110. Second base layer conductive material 135 is, for example, Nickel-Vanadium (Ni-V) deposited to a thickness of approximately 3600 Å (col. 6, ll. 43-47 and FIG. 9). The Nickel-Vanadium second base layer conductive material 135 acts as a diffusion barrier layer and provides good adhesion characteristics to the subsequently deposited solder bump (col. 6, ll. 47-50). Thus, second base layer conductive material 135 appears to correspond to the adhesive metal layer recited in the present claims.

Thereafter, a photoresist is spun over integrated circuit device 100 and patterned through lithography to expose an area 145 over bond pad 110 (col. 6, ll. 51-54 and FIG. 10). Next, solder bump 150, such as for example, a Lead-Tin (Pb-Sn) solder bump, is deposited by electroplating using, for example, a single cup plater (col. 6, ll. 54-57 and FIG. 11). Once formed, photoresist layer 140 is stripped, for example, by a wet chemical stripping process, leaving solder bump 150 overlying the bilayer of conductive materials 130 and 135 and electrically connected to bond pad

110 (col. 6, ll. 59-64 and FIG. 12). Next, the bilayer of conductive materials 130 and 135 overlying soft passivation layer 140 and adjacent solder bump 150 is removed either by a chemical etch or a dry etch to electrically isolate solder bump 150 (col. 6, l. 65-col. 7, l. 2 and FIG. 13). None of FIGS. 5, 14, 16 or 17 show bond pad 110 exposed through either of the bilayer of conductive materials 130 and 135.

Thus, at no point is the bond pad 110 of Dass et al. exposed through either of the bilayer of conductive materials 130 and 135. Dass et al. is silent with regard to (i) a passivation metal layer having a removed portion exposing an underlying metal wire layer, and (ii) an adhesive metal layer on an inner surface of a bond pad contact hole, exposing the metal wire layer (see amended Claims 1 and 4). Therefore, this ground of rejection is unsustainable, and should be withdrawn.

The Rejection of Claims 4-8 under 35 U.S.C. § 112, Second Paragraph

The rejections of Claims 4-8 under 35 U.S.C. § 112, second paragraph have been obviated by appropriate amendment.

Conclusions

In view of the above amendments and remarks, all bases for rejection are believed to be overcome, and the application is believed to be in condition for allowance. Early notice to that effect is earnestly requested.

If it is deemed helpful or beneficial to the efficient prosecution of the present application, the Examiner is invited to contact Applicant's undersigned representative by telephone.

Respectfully submitted,

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